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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/664,499 | 09/18/2000 | Nicos A. Vekiarides | 1942.0040000 | 4607 |

22879 7590 01/30/2006

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| EXAMINER | |
|---|---|
| EL CHANTI, HUSSEIN A | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2157 | |

DATE MAILED: 01/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/664,499 | VEKIARIDES, NICOS A. | |
| | Examiner | Art Unit | |
| | Hussein A. El-chanti | 2157 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *14 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-24 and 26-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24 and 26-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

***Response to Amendment***

**1.** This action is responsive amendment received on Nov. 14, 2005. Claims 48 and 49 were newly added. Claims 1-49 are pending examination.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**2.** Claims 1-21, 24 and 26-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Nelson et al., U.S. Patent No. 5,574,863 (referred to hereafter as Nelson).

As to claim 1, Nelson teaches a method of mirroring data in a computer network, comprising the steps of:

establishing at least one connection between a local storage server and a mirror storage server (see col. 4 lines 52-col. 5 lines 22, communication is established between controller and mirror);

receiving a primary storage request from a network host at the local storage server (see col. 4 lines 52-col. 5 lines 22, request is sent);

sending a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request (see col. 4 lines 52-col. 5 lines 22);

processing the mirror storage request at the mirror storage server (see col. 4 lines 52-col. 5 lines 22, request is processed);

sending a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server (see col. 6 lines 20-30, first heartbeat signal is sent every interval of time);

sending a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server (see col. 6 lines 20-30, second heartbeat response message is sent to the sender); and

monitoring reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively (see col. 6 lines 31-40, an interruption is detected in the second heartbeat signal for being timed out).

As to claim 2, Nelson teaches the method of claim 1, further comprising the steps of: detecting an interruption in the second heartbeat signal at the local storage server; closing the established at least one connection; and queuing mirror storage requests that result from primary storage requests that are received during the detected interruption (see col. 6 lines 31-50).

As to claim 3, Nelson teaches the method of claim 2, further comprising the steps of: receiving the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and re-establishing the closed at least one connection between the local storage server and the mirror storage server (see col. 6 lines 31-50).

As to claim 4, Nelson teaches the method of claim 3, wherein said mirror storage request sending step comprises the step of sending the queued mirror storage requests across the re-established at least one connection after said re-establishing step (see col. 6 lines 31-col. 7 lines 20).

As to claim 5, Nelson teaches the method of claim 4, wherein said detecting step comprises the step of: detecting an interruption in the second heartbeat signal at the local storage server that has a duration longer than a first predetermined amount of time (see col. 6 lines 20-30).

As to claim 6, Nelson teaches the method of claim 3, wherein said re-establishing step comprises the steps of: monitoring the second heartbeat signal for a probationary interval of time; and

re-establishing the closed at least one connection between the local storage server and the mirror storage server only if no interruptions in the second heartbeat signal are detected during said monitoring step (see col. 6 lines 20-col. 7 lines 20).

As to claim 7, Nelson teaches the method of claim 1, wherein said processing step comprises the step of: storing data of the received mirror storage request in a mirror storage device corresponding to a primary storage device (see col. 6 lines 31-col. 7 lines 20).

As to claim 8, Nelson teaches the method of claim 7, further comprising the step of: sending a response across the established at least one connection from the mirror storage server to the local storage server, wherein the response indicates whether said storing data step was successful (see col. 6 lines 20-col. 7 lines 20).

As to claim 9, Nelson teaches the method of claim 5, wherein said establishing step comprises the steps of: establishing n connections between the local storage server and the mirror storage server, wherein each of the n connections is between one of n worker threads in the local storage server and one of n connection threads in the mirror storage server, wherein n >_1; storing a local connection array of n elements on the local storage server, wherein each element of the local connection array corresponds to one of the n local worker thread that operates on the local storage server; and storing a mirror connection array of elements on the mirror storage server, wherein each element of the mirror connection array corresponds to one of the n connection threads on the mirror storage server (see col. 6 lines 31-col. 7 lines 20).

As to claim 10, Nelson teaches the method of claim 9, wherein said local connection array storing step comprises the step of- storing a local connection array of n elements, wherein each element comprises a socket and a timestamp; and wherein said mirror connection array storing step comprises the step of: storing a mirror connection array of n elements, wherein each element comprises a socket parameter and a timestamp parameter (see col. 6 lines 31-col. 7 lines 20).

As to claim 11, Nelson teaches the method of claim 10, wherein said establishing step further comprises the step of establishing each of the n connections according to the socket parameter stored in the corresponding one of the n elements of the stored local connection array (see col. 6 lines 31-col. 7 lines 20).

As to claim 12, Nelson teaches the method of claim 11, further comprising the steps of establishing a mirror heartbeat sender thread and a mirror heartbeat receiver

thread in the mirror storage server; and establishing a local heartbeat sender thread and a local heartbeat receiver thread in the local storage server (see col. 6 lines 31-col. 7 lines 20).

As to claim 13, Nelson teaches the method of claim 12, wherein the first heartbeat signal sending step and said second heartbeat signal sending step each further comprise the step of sending a message at time intervals of a second predetermined amount of time (see col. 6 lines 31-col. 7 lines 20).

As to claim 14, Nelson teaches the method of claim 13, wherein said first heartbeat signal sending step further comprises the step of updating the timestamp parameter of each of the n elements of the mirror connection array whenever the message on the first heartbeat signal is received by the mirror heartbeat receiver thread; and wherein said second heartbeat signal sending step further comprises the step of: updating the timestamp parameter of each of the n elements of the local connection array whenever the message on the second heartbeat signal is received by the local heartbeat receiver thread (see col. 6 lines 31-col. 7 lines 20).

As to claim 15, Nelson teaches the method of claim 14, wherein said detecting step further comprises the step of: indicating in one of the n elements of the mirror connection array that the corresponding one of the established n connections is closed if the timestamp parameter of the one of the n elements is older than the first predetermined amount of time (see col. 6 lines 31-col. 7 lines 20).

As to claim 16, Nelson teaches the method of claim 15, wherein said closing step comprises the steps of timing out one of the n connection threads on the mirror storage

server if a request on the corresponding one of the established n connections has not arrived in a third predetermined amount of time; and closing and exiting the timed out connection thread if the corresponding one of the n elements in the mirror connection array is indicated to be closed (see col. 6 lines 31-col. 7 lines 20).

As to claim 17, Nelson teaches the method of claim 16, further comprising the steps of receiving a first message on the first heartbeat signal after an interruption of the first heartbeat signal; and

re-establishing the n connections between the local storage server and the corresponding connection threads on the mirror storage server (see col. 6 lines 31-col. 7 lines 20).

As to claim 18, Nelson teaches the method of claim 17, wherein said second heartbeat signal receiving step comprises the step of: receiving a first message on the second heartbeat signal after an interruption of the second heartbeat signal (see col. 6 lines 31-col. 7 lines 20).

As to claim 19, Nelson teaches the method of claim 1, wherein the local storage server is operating in an asynchronous mirror mode, further comprising the steps of: processing the primary storage request; and sending the results of the processed primary storage request to the network host (see col. 6 lines 31-col. 7 lines 20).

As to claim 20, Nelson teaches the method of claim 1, wherein the local storage server is operating in a synchronous mirror mode, further comprising the steps of: processing the primary storage request; waiting for a response corresponding to the sent mirror storage request from the mirror storage server; and sending the results of

the processed primary storage request to the network host after the response is received from the mirror storage server (see col. 6 lines 31-col. 7 lines 20).

As to claim 21, Nelson teaches the method of claim 1, further comprising the step of: determining whether a LUN related to the received primary storage request is designated to be mirrored (see col. 6 lines 31-col. 7 lines 20).

As to claims 24, 48 and 49, Nelson teaches a method of bi-directional mirroring of data in computer networks, comprising the steps of: establishing a first connection between a local storage server and a remote storage server; establishing a second connection between the local storage server and the remote storage server; receiving a first local storage request from a first network host at the local storage server; sending a first local mirror storage request from the local storage server across the first connection, wherein the first local mirror storage request corresponds to the first received local storage request; receiving the first local mirror storage request at the remote storage server; storing data received in the first local mirror storage request in at least one remote storage device coupled to the remote storage server; receiving a first remote storage request from a second network host at the remote storage server; sending a first remote mirror storage request from the remote storage server across the second connection, wherein the first remote mirror storage request corresponds to the received first remote storage request; receiving the first remote mirror storage request at the local storage server; and storing data received in the first remote mirror storage request in at least one local storage device coupled to the local storage server (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20);

sending a first heartbeat signal from the local storage server to the mirror storage server; and sending a second heartbeat signal from the remote storage server to the local storage server (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 26, Nelson teaches the method of claim 24, further comprising the steps of: detecting an interruption in the second heartbeat signal at the local storage server; closing the established first connection; receiving at least a second local storage request at the local storage server; and queuing at least a second local mirror storage request at the local storage server,

wherein the at least a second local mirror storage request corresponds to the received at least a second local storage request (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 27, Nelson teaches the method of claim 26 further comprising the steps of: receiving the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and

re-establishing the closed first connection between the local storage server and the mirror storage server (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 28, Nelson teaches the method of claim 27, further comprising the step of: sending the queued at least a second local mirror storage request across the reestablished first connection after said re-establishing step (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 29, Nelson teaches the method of claim 25, further comprising the steps of: detecting an interruption in the first heartbeat signal at the remote storage server; closing the established second connection; receiving at least a second remote storage request at the remote storage server; and queuing the at least a second remote mirror storage request at the remote storage server, wherein the at least a second remote mirror storage request corresponds to the received at least a second remote storage request (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 30, Nelson teaches the method of claim 29, further comprising the steps of: receiving the first heartbeat signal at the remote storage server after the detected interruption of the first heartbeat signal; and re-establishing the closed second connection between the local storage server and the mirror storage server (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 31, Nelson teaches the method of claim 30, further comprising the step of: sending the queued at least a second remote mirror storage request across the reestablished second connection after said re-establishing step (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 32, Nelson teaches A system for mirroring data in a computer network, comprising: a local storage server that receives a storage request and outputs a mirror storage request, wherein said local storage server outputs a first heartbeat signal at regular first intervals; and a mirror storage server that receives said mirror storage request, wherein said mirror storage server processes said mirror storage request, wherein said mirror storage server outputs a response corresponding to said

mirror storage request to said local storage server, wherein said mirror storage server outputs a second heartbeat signal at regular second intervals and monitors reception of said first heartbeat signal for interruption in the regular receipt thereof; wherein said local storage server reception of said second heartbeat signal for interruption in the regular receipt thereof (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 33, Nelson teaches the system of claim 32, wherein said local storage server comprises: a local work thread generator module that generates n local worker threads; and a local connection array that includes n elements; and wherein said a mirror storage server comprises: a mirror connection array that comprises n elements; and a mirror connection thread generator module that generates n mirror connection threads (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 34, Nelson teaches the system of claim 33, wherein each of said n mirror connection threads are connected to a corresponding one of said n local worker threads using a corresponding socket parameter stored in each of said n elements of said mirror connection array to form n corresponding connections (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 35, Nelson teaches the system of claim 34, wherein said local storage server comprises: a local heartbeat thread generator module that generates a local heartbeat sender thread and a local heartbeat receiver thread; and wherein said mirror storage server comprises: a mirror heartbeat thread generator module that generates a mirror heartbeat sender thread and a mirror heartbeat receiver thread;

wherein said local heartbeat sender thread sends said first heartbeat signal to said mirror heartbeat receiver thread, and said mirror heartbeat sender thread sends said second heartbeat signal to said local heartbeat receiver thread (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 36, Nelson teaches the system of claim 35, wherein each of n elements of said local connection array comprises a timestamp parameter, wherein said local heartbeat receiver thread updates each said timestamp parameter in said local connection array when a message is received on said second heartbeat signal (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 37, Nelson teaches the system of claim 36, wherein said local heartbeat sender thread indicates in at least one of the n elements of the mirror connection array that the corresponding at least one of the established n connections is closed if the corresponding timestamp parameter is older than the first predetermined amount of time (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 38, Nelson teaches the system of claim 36, wherein one of said n mirror connection threads times out if a corresponding mirror storage request is not received from said local storage server for a second predetermined amount of time, wherein after said time out said one of said n mirror connection threads checks the timestamp of the corresponding one of the n elements and exits if said corresponding timestamp is older than a second predetermined amount of time (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20)

As to claim 39, Nelson teaches A computer program product comprising a computer useable medium having computer program logic recorded thereon for enabling at least one processor to mirror data in a computer network, said computer program logic comprising: means for enabling the processor to establish at least one connection between a local storage server and a mirror storage server; means for enabling the processor to receive a primary storage request from a network host at the local storage server; means for enabling the processor to send a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request; means for enabling the processor to send a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server; and means for enabling the processor to send a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server; and means for monitoring reception of at least one the first heartbeat signal and the second heartbeat signal for interruption in the regular receipt thereof, respectively (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 40, Nelson teaches the computer program product of claim 39, further comprising: means for enabling the processor to detect an interruption in the second heartbeat signal at the local storage server; and means for enabling the processor to queue mirror storage requests that result from primary storage requests that are received during the detected interruption (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 41, Nelson teaches the computer program product of claim 40, further comprising: means for enabling the processor to receive the second heartbeat signal at the local storage server after the detected interruption of the second heartbeat signal; and means for enabling the processor to re-establish the closed at least one connection between the local storage server and the mirror storage server (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 42, Nelson teaches the computer program product of claim 41, further comprising: means for enabling the processor to send the queued mirror storage requests across the re-established at least one connection (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

As to claim 43, Nelson teaches the method of claim 39, further comprising the step of: means for enabling the processor to receive a response across the established at least one connection from the mirror storage server, wherein the response indicates whether data in said sent mirror storage request was successfully stored in a mirror storage device (see col. 6 lines 20-col. 7 lines 20 and col. 4 lines 52-col. 5 lines 20).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

**3.** Claim 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson.

As to claim 22, Nelson teaches establishing at least one connection between a local storage server and a mirror storage server, receiving a primary storage request from a network host at the local storage server, sending a mirror storage request across the established at least one connection from the local storage server to the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request, processing the mirror storage request at the mirror storage server, sending a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server and sending a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server.

Nelson does not explicitly teach the established at least one connection is a TCP connection. Official notice is taken that one of the ordinary skill in the art at the time of the invention would be motivated to use Nelson's invention using a TCP connection because it adds reliable communication and flow control and provides full-duplex process-to-process connections.

**4.** Claims 23 and 44-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson in view of Benett.

As to claims 23 and 44-47, Nelson teaches establishing at least one connection between a local storage server and a mirror storage server, receiving a primary storage request from a network host at the local storage server, sending a mirror storage request across the established at least one connection from the local storage server to

the mirror storage server, wherein the mirror storage request corresponds to the received primary storage request, processing the mirror storage request at the mirror storage server, sending a first heartbeat signal at regular first intervals from the local storage server to the mirror storage server and sending a second heartbeat signal at regular second intervals from the mirror storage server to the local storage server.

Nelson does not explicitly teach the limitation "sending UDP protocol message". However Bennett teaches a method for sending and receiving UDP messages between a host and a mirror server (see col. 5 lines 55-col. 6 lines 19).

It would have been obvious for one of the ordinary skill in the art at the time of the invention to modify Nelson by implementing the step of sending UDP messages as taught by Bennett because doing so would allow the user to send request to host servers more efficiently and in a faster manner.

***Response to Arguments***

**5.** Applicant's arguments have been considered but are not persuasive. Applicant argues in substance that Nelson does not disclose heartbeat signal and the "are-u-active message" taught by Nelson may not be interpreted as heartbeat signal.

In response, Nelson explicitly teaches that the "are-u-active message" may be a heartbeat signal (see col. 6 lines 20-30).

**6.** **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**7.** Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hussein A. El-chanti whose telephone number is (571)272-3999. The examiner can normally be reached on Mon-Fri 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ario Etienne can be reached on (571)272-4001. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hussein El-chanti

August 3, 2005

ARIO ETIENNE
PRIMARY EXAMINER